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AUTHORITY

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NAVAL AIR ENGINEERING CENTER
PHILADELPHIA, PENNSYLVANIA 19112
AERONAUTICAL MATERIALS LABORATORY
CHEMICAL ENGINEERING DIVISION

DATE 7 December 1964

REPORT NO. NAEC AML 2077

Method for Determining Concentration of Aircraft Engine Corrosion Preventive Compound in a Preservative-Lubricating Oil Mixture

PAN 12-82 UNDER BUWEPS WEPTASK
RRMA 05 010/200 1/R007 08 01

A. Object:

The object of this investigation was to develop a simple and accurate technique for determining the concentration of MIL-C-6529C preservative compound in a mixture of lubricating oil and preservative compound after it has been used in the aircraft engine preservation runs established by the Handbook of Preservation of Uninstalled Aircraft Engines, reference (a).

B. History:

The quantity of preservative compound necessary to maintain an effective level of protection for aircraft engines in a preservation program was reported in reference (b). It was pointed out that the current procedure requires the replenishment of the preservation mixture to compensate for dilution by residual operating oil trapped in the engine. Therefore, a reliable method of determining the concentration of preservative compound in a mixture of lubricating oil and preservative compound is necessary. To this end, reference (c) requested the Aeronautical Materials Laboratory to determine whether tracer compounds can be added to the preservative concentrate which could then be quantitatively determined in a mixture of used oil and preservative using equipment and techniques available at O&R departments of Naval Air Stations.

C. Discussion:

Reference (c) suggested that emission spectrography and infrared spectrophotometry be considered for determining the suitability of tracer compound additives for use in development of a method of analysis. Reference (b) reported that an emission spectrographic method for determining the quantity of silicone oil additive gave variable results when employed with mixtures of used engine oil: preservative compound. However, since emission spectrography limits consideration of possible tracer additives to metallic elements, which would be undesirable if retained in the engine system, further consideration was not given to this method.

Infrared analysis of current lubricant and preservative compounds indicated insufficient sensitivity for the detection of low concentrations of additive materials unless time-consuming and often difficult chemical separations were undertaken.

D. Method:

Evaluation of a spectrophotometric procedure for measuring the light transmission values of a tracer-dye additive at a characteristic wavelength was undertaken, since colorimetric equipment is normally available at the various O&R laboratories. The selected tracer-dye must be metal-free and soluble in the preservative compound and in the lubricating oil-preservative mixture. The specific absorption wavelength of the tracer-dye additive would then provide a means of quantitative determination of the preservative concentrate without interference by contaminants in the used engine oil. It was found that Blue Mist Dye supplied by Fisher Scientific Company fulfilled these requirements.

(a) Apparatus - Beckman Model DU Spectrophotometer or equivalent.

Instrument settings were:		
	Wavelength	59[illegible] mu
	Slit Width	0.1 mm
	Phototube	Red
	Transmission Cells	(2) Silica Cells, 10 mm pathlength

(b) Reagents - Blue Mist Dye, Fisher Scientific Company
MIL-L-22851A Lubricating Oil
MIL-C-6529C Corrosion Preventive Compound
Aliphatic Petroleum Naphtha

(c) Procedure - 0.100 gram Blue Mist Dye was dissolved in 100 ml MIL-C-6529C preservative compound, using heat and agitation to effect the solution. A 5 ml aliquot of the preservative concentrate-dye mixture was transferred to a 100 ml volumetric flask and diluted to the mark with aliphatic petroleum naphtha. The absorption wavelength of the Blue Mist Dye was 597 millimicrons. It was determined that similar solutions of lubricating oil and preservative concentrate without the dye would cause no interference with transmission readings at this wavelength.

The original MIL-C-6529C preservative concentrate-dye mixture was diluted with MIL-L-22851A lubricating oil to produce concentrations of 5%, 10%, 15%, 20%, 25%, 50% and 75%.

A five ml aliquot of each of these mixtures was diluted to 100 ml with aliphatic petroleum naphtha.

A blank using 5 ml of MIL-L-22851A lubricating oil containing no dye was similarly prepared and used for setting the 100% transmission point on the spectrophotometer. Transmission readings of all the aliquot solutions were then made.

E. Results:

The transmission values of the preservative compound-tracer dye-lubricating oil mixtures are shown on Plate 1. The percentage of preservative compound derived therefrom is in very close agreement with the known concentration in the mixtures tested.

The color stability of the tracer-dye was checked by heating the mixtures used in the preparation of the calibration chart in an oven for 30 minutes at 350°F. Comparative transmission readings of aliquot samples of the heated and unheated mixtures also appear on Plate 1. The color stability of the tracer-dye is considered to be quite satisfactory.

Prepared by: E R Wright
E. R. WRIGHT
PROJECT ENGINEER
M Perlman
M. PERLMAN
PROJECT ENGINEER

Approved by: J Smith
J. SMITH, HEAD
CHEMISTRY BRANCH

REFERENCES

(a) BUWEPS Handbook (NAVWEPS 15-02-500) Preservation of Uninstalled Aircraft Engines

(b) NAS, Jacksonville Materials Engineering Report No. 150-63 of 31 Dec 1963, Preservation of Reciprocating Engines, Modified Procedure

(c) Problem Assignment No. 12-82, Concentration of MIL-C-6529 Preservative Compound in a Preservative-Lubricating Oil Mixture, Development of Technique for Determining

PLATE 1 - Chart of Transmissions of Dye-Concentrate Lubricating-Oil Mixtures

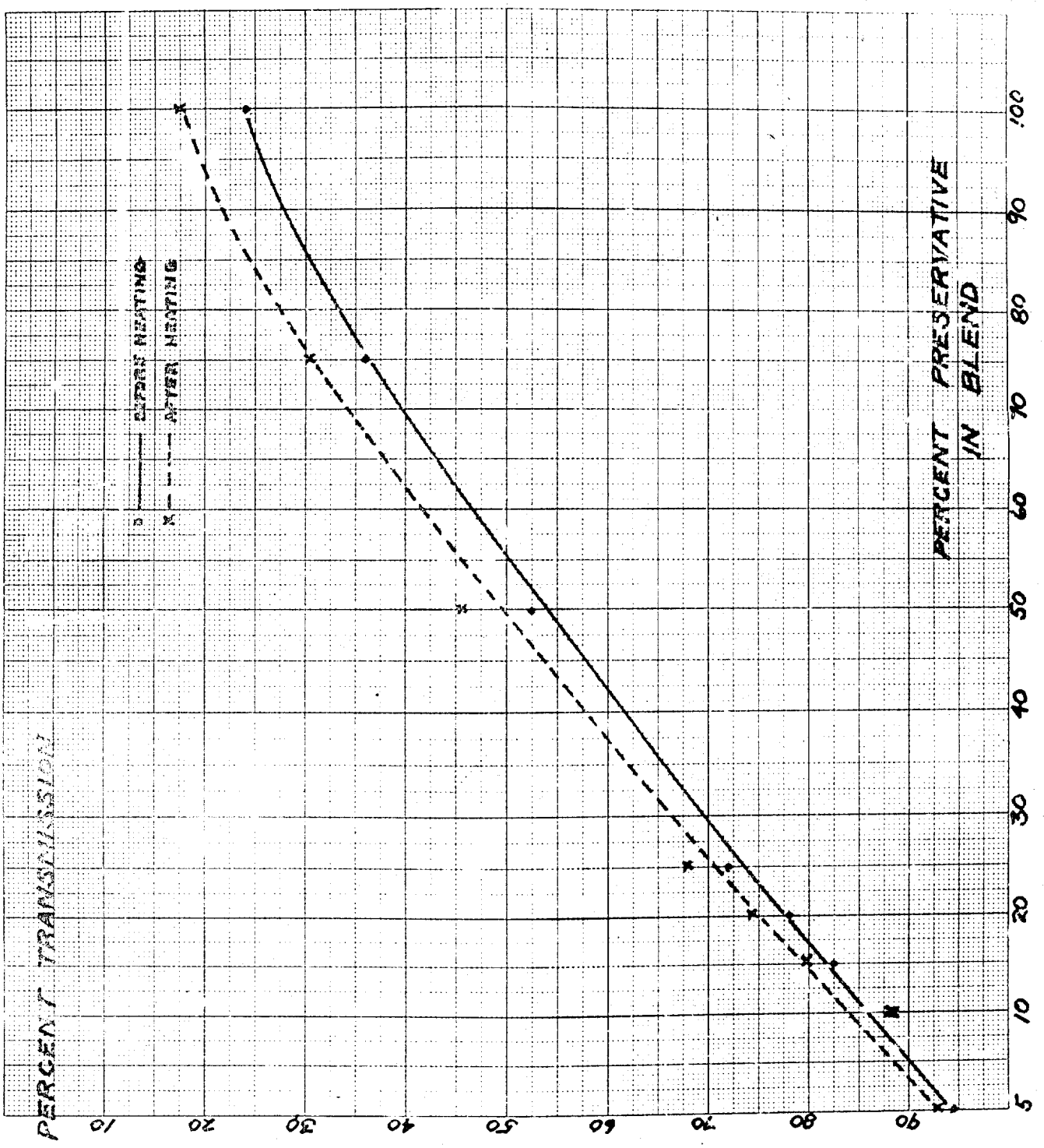

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PLATE 1

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